

CLAIM AMENDMENTS

1 1. (original) Method for the estimation of the transfer
2 function of at least one transmission channel in a receiving system
3 for telecommunications networks through the computation by means of
4 an interpolation algorithm of a plurality of channel coefficients
5 comprised between two groups of known channel coefficients, each
6 channel coefficient being associated to an integer value of the
7 abscissa on a time axis characterised in that the computation of
8 said plurality of channel coefficients is carried out by repeatedly
9 applying an interpolation algorithm capable of calculating an
10 intermediate point ($Z, f(Z)$) between a first extreme and a second
11 extreme of a defined interval, said first extreme being formed by
12 two known points and said second extreme being formed by at least
13 one known point, said intermediate point having as abscissa (Z) the
14 abscissa value of the mean point between the points defining said
15 interval rounded off to the integer closest to said first extreme,
16 and having as ordinate ($f(Z)$) the arithmetic average between the
17 ordinate of the known point of said second extreme and the ordinate
18 of a point, chosen between two known points of said first extreme,
19 having a distance from said intermediate point, on said time axis,
20 equal to the distance between said intermediate point and the known
21 point of said second extreme.

1 2. (original) Method according to claim 1, wherein said
2 channel coefficients to be calculated are comprised between a first
3 known channel coefficient, of abscissa A, corresponding to a last
4 pilot symbol of a current slot (L) and a second known channel
5 coefficient, of abscissa B, corresponding to a first pilot symbol
6 of a slot (L+1) subsequent to said current slot, being additionally
7 known a third channel coefficient, of abscissa A-1, on the left-
8 t-hand of said first channel coefficient of abscissa A, and the
9 computation of said channel coefficients is carried out through
10 the following steps:

11 a) repeatedly applying in a recursive manner said
12 interpolation algorithm in the interval defined by said known
13 channel coefficients of abscissa A and B, by carrying out a first
14 iteration in which a first intermediate coefficient (of abscissa C)
15 is calculated; and by performing the subsequent iterations of the
16 same algorithm in sub-intervals, defined each time on the left-hand
17 by said known channel coefficient of abscissa A and on the right-
18 t-hand by the intermediate coefficient, calculated in the preceding
19 iteration, until the abscissa point A+1 is reached and computed;

20 b) searching, by increasing abscissas, for a first point,
21 still to be calculated, on the right-hand of the last intermediate
22 coefficient calculated; defining as extremes of a new application
23 interval of said interpolation algorithm, the first known left-hand
24 point and the first known right-hand point with respect to said
25 point still to be calculated; and further applying, in a recursive

26 manner, said interpolation algorithm to said new interval, by
27 carrying out subsequent iteration of the same algorithm in
28 sub-intervals defined from time to time by the intermediate
29 coefficient calculated in the preceding iteration, until the point
30 immediately adjacent to the left-hand extreme of said new interval
31 is reached and calculated;

32 c) repeating step b) until the channel coefficient
33 associated to the value of abscissa B-1 is calculated.

1 3. (original) Method according to claim 2, wherein each
2 slot contains three pilot symbols (0, 1, 2), said first known
3 channel coefficient of abscissa A is the coefficient
4 $C(2) = C_I(2) + C_Q(2)$ corresponding to the last pilot symbol (2) of
5 the current slot (L), said second known channel coefficient of
6 abscissa B is the coefficient $C(10) = C_I(10) + C_Q(10)$
7 corresponding to the first pilot symbol (10) of a subsequent slot
8 (L+1), and said third known channel coefficient of abscissa A-1 is
9 the coefficient $C(1) = C_I(1) + C_Q(1)$ corresponding to the last but one
10 pilot symbol (1) of the current slot (L) and the computation of
11 channel coefficients $C(k) = C_I(k) + C_Q(k)$, with $k = 3..9$, is
12 performed according to the following sequence:

$$13 \quad C_I(6) = [C_I(2) + C_I(10)]/2 ; C_Q(6) = [C_Q(2) + C_Q(10)]/2;$$

$$14 \quad C_I(4) = [C_I(2) + C_I(6)]/2 ; C_Q(4) = [C_Q(2) + C_Q(6)]/2;$$

$$15 \quad C_I(3) = [C_I(2) + C_I(4)]/2 ; C_Q(3) = [C_Q(2) + C_Q(4)]/2;$$

$$16 \quad C_I(5) = [C_I(4) + C_I(6)]/2 ; C_Q(5) = [C_Q(4) + C_Q(6)]/2;$$

$$\begin{aligned}
17 \quad C_I(8) &= [C_I(6) + C_I(10)]/2 ; C_Q(8) = [C_Q(6) + C_Q(10)]/2; \\
18 \quad C_I(7) &= [C_I(6) + C_I(8)]/2 ; C_Q(7) = [C_Q(6) + C_Q(8)]/2; \\
19 \quad C_I(9) &= [C_I(8) + C_I(10)]/2 ; C_Q(9) = [C_Q(8) + C_Q(10)]/2.
\end{aligned}$$

1 4. (original) Method according to claim 2, wherein each
 2 slot contains four pilot symbols (0, 1, 2, 3), said first known
 3 channel coefficient of abscissa A is the coefficient $C(3) = C_I(3)$
 4 $+ C_Q(3)$ corresponding to the last pilot symbol (3) of the current
 5 slot (L), said second known channel coefficient of abscissa B is
 6 the coefficient $C(10) = C_I(10) + C_Q(10)$ corresponding to the first
 7 pilot symbol (10) of a subsequent slot (L+1), and said third known
 8 channel coefficient of abscissa A-1 is the coefficient. (original)
 9 $C(2) = C_I(2) + C_Q(2)$ corresponding to the last but one pilot
 10 symbol (2) of the current slot (L), and the computation of the
 11 channel coefficients $C(k) = C_I(k) + C_Q(k)$, with $k = 4..9$, is
 12 performed according to the following sequence:

$$\begin{aligned}
13 \quad C_I(6) &= [C_I(2) + C_I(10)]/2 ; C_Q(6) = [C_Q(2) + C_Q(10)]/2; \\
14 \quad C_I(4) &= [C_I(2) + C_I(6)]/2 ; C_Q(4) = [C_Q(2) + C_Q(6)]/2; \\
15 \quad C_I(5) &= [C_I(4) + C_I(6)]/2 ; C_Q(5) = [C_Q(4) + C_Q(6)]/2; \\
16 \quad C_I(8) &= [C_I(6) + C_I(10)]/2 ; C_Q(8) = [C_Q(6) + C_Q(10)]/2; \\
17 \quad C_I(7) &= [C_I(6) + C_I(8)]/2 ; C_Q(7) = [C_Q(6) + C_Q(8)]/2; \\
18 \quad C_I(9) &= [C_I(8) + C_I(10)]/2 ; C_Q(9) = [C_Q(8) + C_Q(10)]/2.
\end{aligned}$$

1 5. (original) Method according to claim 2, wherein each
 2 slot contains five pilot symbols (0, 1, 2, 3, 4), said first known

3 channel coefficient of abscissa A is the coefficient . (original)
 4 $C(4) = C_I(4) + C_Q(4)$ corresponding to the last pilot symbol (4) of
 5 current slot (L), said second known channel coefficient of abscissa
 6 B is the coefficient $C(10) = C_I(10) + C_Q(10)$ corresponding to the
 7 first pilot symbol (10) of a subsequent slot (L + 1), and said
 8 third known channel coefficient of abscissa A-1 is the coefficient
 9 $C(3) = C_I(3) + C_Q(3)$ corresponding to the last but one pilot symbol
 10 (3) of the current slot (L), and the computation of the channel
 11 coefficients $C(k) = C_I(k) + C_Q(k)$, with $k = 5..9$, is performed
 12 according to following sequence:

13 $C_I(7) = [C_I(4) + C_I(10)]/2$; $C_Q(7) = [C_Q(4) + C_Q(10)]/2$;
 14 $C_I(5) = [C_I(3) + C_I(7)]/2$; $C_Q(5) = [C_Q(3) + C_Q(7)]/2$;
 15 $C_I(6) = [C_I(5) + C_I(7)]/2$; $C_Q(6) = [C_Q(5) + C_Q(7)]/2$;
 16 $C_I(8) = [C_I(6) + C_I(10)]/2$; $C_Q(8) = [C_Q(6) + C_Q(10)]/2$;
 17 $C_I(9) = [C_I(8) + C_I(10)]/2$; $C_Q(9) = [C_Q(8) + C_Q(10)]/2$.

1 6. (original) Method according to claim 2, wherein each
 2 slot contains six pilot symbols (0, 1, 2, 3, 4, 5), said first
 3 known channel coefficient of abscissa A is the coefficient
 4 $C(5) = C_I(5) + C_Q(5)$ corresponding to the last pilot symbol (5) of
 5 the current slot (L), said second known channel coefficient of
 6 abscissa B is the coefficient $C(10) = C_I(10) + C_Q(10)$
 7 corresponding to the first pilot symbol (10) of a subsequent slot
 8 (L+1), and said third known channel coefficient of
 9 abscissa A-1 is the coefficient $C(4) = C_I(4) + C_Q(4)$

10 corresponding to the last but one pilot symbol (4) of the current
11 slot (L), and the computation of the channel coefficients $C(k)$
12 $= C_I(k) + C_Q(k)$, with $k = 6..9$, is performed according to
13 following sequence:

14 $C_I(7) = [C_I(4) + C_I(10)]/2$; $C_Q(7) = [C_Q(4) + C_Q(10)]/2$;
15 $C_I(6) = [C_I(5) + C_I(7)]/2$; $C_Q(6) = [C_Q(5) + C_Q(7)]/2$;
16 $C_I(8) = [C_I(6) + C_I(10)]/2$; $C_Q(8) = [C_Q(6) + C_Q(10)]/2$;
17 $C_I(9) = [C_I(8) + C_I(10)]/2$; $C_Q(9) = [C_Q(8) + C_Q(10)]/2$.

1 7. (original) Method according to claim 2, wherein each
2 slot contains seven pilot symbols (0, 1, 2, 3, 4, 5, 6), said first
3 known channel coefficient of abscissa A is the coefficient.

4 (original) $C(6) = C_I(6) + C_Q(6)$ corresponding to the last pilot
5 symbol (6) of the current slot (L), said second known channel
6 coefficient is the coefficient $C(10) = C_I(10) + C_Q(10)$
7 corresponding to the first pilot symbol (10) of a subsequent slot
8 (L + 1), and said third known channel coefficient of abscissa A-1
9 is the coefficient $C(5) = C_I(5) + C_Q(5)$ corresponding to the last
10 but one pilot symbol (5) of the current slot (L), and the
11 computation of the channel coefficients $C(k) = C_I(k) + C_Q(k)$, with
12 $k = 7..9$, is performed following the sequence:

13 $C_I(8) = [C_I(6) + C_I(10)]/2$; $C_Q(8) = [C_Q(6) + C_Q(10)]/2$;
14 $C_I(7) = [C_I(6) + C_I(8)]/2$; $C_Q(7) = [C_Q(6) + C_Q(8)]/2$;
15 $C_I(9) = [C_I(8) + C_I(10)]/2$; $C_Q(9) = [C_Q(8) + C_Q(10)]/2$.

1 8. (original) Method according to claim 2, wherein each
2 slot contains eight pilot symbols (0, 1, 2, 3, 4, 5, 6, 7), said
3 first known channel coefficient of abscissa A is the coefficient
4 $C(7) = C_I(7) + C_Q(7)$ corresponding to the last pilot symbol (7) of
5 the current slot (L), said second known channel coefficient of
6 abscissa B is the coefficient $C(10) = C_I(10) + C_Q(10)$
7 corresponding to the first pilot symbol (10) of a subsequent slot
8 (L + 1), and said third known channel coefficient of abscissa A-1
9 is the coefficient $C(6) = C_I(6) + C_Q(6)$ corresponding to the last
10 but one pilot symbol (6) of the current slot (L), and the
11 computation of the channel coefficients $C(k) = C_I(k) + C_Q(k)$, with
12 $k = 8, 9$, is performed according to the sequence:
13 $C_I(8) = [C_I(6) + C_I(10)]/2$; $C_Q(8) = [C_Q(6) + C_Q(10)]/2$;
14 $C_I(9) = [C_I(8) + C_I(10)]/2$; $C_Q(9) = [C_Q(8) + C_Q(10)]/2$.

1 9. (original) Method according to claim 1, wherein said
2 channel coefficients to be calculated are comprised between a first
3 known channel coefficient of abscissa A, corresponding to a last
4 pilot symbol of a current slot (L), and a second known channel
5 coefficient of abscissa B, corresponding to a first pilot symbol of
6 a slot (L+1) subsequent to said current slot, being additionally
7 known a third channel coefficient of abscissa B + 1, on the right
8 hand of said first channel coefficient of abscissa B, and the
9 computation of said channel coefficients is performed through the
10 steps of:

11 a) repeatedly applying, in a recursive manner, said
12 interpolation algorithm in the interval defined by said known
13 channel coefficients of abscissa A and B, by carrying out a first
14 iteration in which a first intermediate coefficient (of abscissa C)
15 is calculated and by performing subsequent iterations of the same
16 algorithm in sub-intervals defined from time to time on the
17 right-hand by said known channel coefficient of abscissa B and on
18 the left-hand by the intermediate coefficient derived in the
19 preceding iteration, until the abscissa point B - 1 is reached and
20 calculated;

21 b) searching, by decreasing abscissas, for a first point
22 still to be calculated on the left-hand of the last intermediate
23 coefficient calculated; defining, as extremes of a new application
24 interval of said interpolation algorithm, the first known left hand
25 point and the first known right-hand point with respect to said
26 point still to be calculated; and further applying, in a recursive
27 manner, said interpolation algorithm on said new interval, by
28 carrying out subsequent iterations of the same algorithm in
29 sub-intervals defined from time to time by the right hand extreme
30 of said new interval and by a left hand extreme formed by the
31 intermediate coefficient derived in the previous iteration, until
32 the point immediately adjacent to the right hand extreme of said
33 new interval is reached and calculated;

34 c) repeating step b) until the channel coefficient
35 associated to the value of abscissa A + 1 is calculated.

1 10. (original) Method according to claim 1, wherein
2 said channel coefficients to be calculated are comprised between
3 two known left-hand channel coefficients, corresponding to the last
4 two pilot symbols of a current slot (L), and two known right-hand
5 channel coefficients, corresponding to the first two pilot symbols
6 of a slot (L + 1) subsequent to said current slot, and the
7 computation of said channel coefficients is performed by applying
8 the first time said interpolation algorithm for calculating an
9 intermediate coefficient, thus dividing into two sub-intervals the
10 interval comprised between said known left-hand channel
11 coefficients and said known right hand channel coefficients, and by
12 subsequently applying, in parallel, to said sub-intervals said
13 interpolation algorithm for computing the remaining channel
14 coefficients comprised in each of said sub-intervals.

1 11. (original) Method according to claim 1, wherein at
2 least one known point of said first or second extreme is a point
3 which has been obtained through a linear combination of known
4 channel coefficients.

1 12. (currently amended) Method according to ~~any of the~~
2 ~~preceding claims~~ claim 1, wherein said communications network is a
3 radio mobile telecommunications network of UMTS type.

1 13. (currently amended) Device for the estimation of
2 the transfer function of a transmission channel in a receiving
3 system for a telecommunications network, comprising:

4 a memory (100) capable of storing channel coefficients
5 corresponding to a current slot (L) and at least one channel
6 coefficient corresponding to a slot (L + 1) subsequent to said.
7 (original) current slot (L);

8 interpolation means (104, 106, 108, 110) capable of
9 reading from said memory (100) a first and a second operand,
10 corresponding to known channel coefficients, and of writing into
11 said memory (100) a value corresponding to the arithmetic average
12 between said first and second operand, said value corresponding to
13 a new channel coefficient;

14 a logic control unit (102) for addressing in reading and
15 writing (R/W) said memory (100) and for controlling said
16 interpolation means (104, 106), so as to perform through individual
17 interpolation operations, the computation and the storage into such
18 memory (100) of individual channel coefficients;
19 characterised in that said logic control unit (102) carries.
20 (original) out a series of interpolation operations according to
21 the method described in ~~any of the claims from 1 to 12~~ claim 1.

1 14. (currently amended) Radio base station, of the type
2 comprising a Rake receiver for receiving signals coming from mobile
3 terminals, equipped with a device for the estimation of the

4 transfer function of a transmission channel through the computation
5 of a plurality of channel coefficients, characterised in that said
6 estimation of the transfer function is performed according to the
7 method described in ~~any of the claims from 1 to 12~~ claim 1.

1 15. (currently amended) Mobile terminal, of the type
2 comprising a receiver for the reception of signals coming from a
3 radio base station, equipped with a device for the estimation of
4 the transfer function of a transmission channel through the
5 computation of a plurality of channel coefficients, characterised
6 in that said estimation of the transfer function is performed.
7 (original) according to the method described in ~~any of the claims~~
8 ~~1 to 12~~ claim 1.